UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/786,388	02/25/2004	Christof Streck	2000.110400	2900

23720 7590 03/17/2006

WILLIAMS, MORGAN & AMERSON
10333 RICHMOND, SUITE 1100
HOUSTON, TX 77042

EXAMINER	
TRAN, BINH X	

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 03/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/786,388	STRECK ET AL.	
	Examiner	Art Unit	
	Binh X. Tran	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 February 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *07-12-2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The examiner considers the Park et al. (US 6,590,241) in the IDS filed on 07-12-2004. However, the examiner does not consider the foreign patents document because they fail to comply with 37 CFR 1.98(a)(3) because it does not include a concise explanation of the relevance, as it is presently understood by the individual designated in 37 CFR 1.56(c) most knowledgeable about the content of the information, of each patent listed that is not in the English language. It has been placed in the application file, but the information referred to therein has not been considered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 9, 11, 20, 22, 27, 33 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 9, 20, and 27, the term "contaminations" lack antecedent basis. Applicants fail to recite the step of penetrating contaminations in the surface in the previous claims. For purpose of examination, the examiner will assume forming a doped region read on the limitation of penetrating contaminations.

Claim 11 recites the limitation "said under-etch" in claim 1. There is insufficient antecedent basis for this limitation in the claim.

Claim 22 recites the limitation "said under-etch" in claim 14. There is insufficient antecedent basis for this limitation in the claim.

In line 1 of claim 27, "typical penetration depth" is subjective and indefinite. It is unclear from the claim, what specific penetration depth that applicant consider as "typical".

Claim 33 indirectly depends on claim 30. In claim 30, applicant defines that the diluted etch solution comprise HF. However in claim 33, applicants defines the diluted etch solution comprise ammonium hydroxide and hydrogen peroxide, which is contradicted to previous limitation (i.e. HF solution). Therefore, it is unclear from the claims whether applicants wish to apply two different diluted etch solutions or not. If applicants wishes to recites two different diluted etch solutions, the examiner recommends applicants label each diluted etch solution with "first" and "second" in order to avoid any confusion.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1, 3-4, 11, 23-24, 29 are rejected under 35 U.S.C. 102(e) as being anticipated by Ryu et al. (US 2002/0146888).

Respect to claim 1, Ryu discloses a method comprising the step of:

forming a doped region of a specified doping profile in a silicon region adjacent to a gate electrode (18) having sidewall spacers (20) formed therein (Fig 1, paragraph 0021);

removing a surface layer of the doped regions by performing an etching process using a diluted etch solution (paragraphs 0022-0023, Fig 3);

epitaxially growing a silicon layer (36) on said doped regions after said surface layer is removed (paragraph 0025, Fig 5).

Respect to claim 3 and 23, Ryu teaches the diluted etch solution comprises ammonium hydroxide and hydrogen peroxide (paragraph 0023). Respect to claims 4 and 24, Ryu teaches the step of cleaning the surface layer prior to removing said surface so as to remove oxide residues (paragraph 0022). Respect to claims 11 and 29, Ryu discloses the step of forming a metal silicide in the grown silicon layer and the doped region having a lateral dimension (paragraph 0025).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein

were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 2, 7, 12-15, 18, 22, 30-33, 35-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ryu in view of Tsukamoto (US 2001/0029074).

Respect to claims 2, 14 Ryu fails to disclose the dilute etch solution comprise HF, hydrogen peroxide, and water. However, Ryu clearly discloses the dilute etch comprises ammonium hydroxide, and hydrogen peroxide. In a semiconductor process, Tsukamoto teaches to use either a mixed solution of HF and hydrogen peroxide or a mixed solution of ammonium hydroxide and hydrogen peroxide (paragraph 34). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ryu in view of Tsukamoto by using HF and hydrogen peroxide solution because equivalent and substitution of one for the other would produce an expected result.

Respect to claim 7, Ryu teaches the removing said surface includes intermittently applying the etch solution and cleaning the surface layer at least one during a discontinuation of the etch solution application (paragraph 0022-0024).

Respect to claims 12 and 30, Ryu fails to disclose to use diluted oxidizing solution comprises sulfuric acid and hydrogen peroxide prior to removing said surface. However, Ryu clearly discloses the dilute oxidizing solution comprises ammonium

hydroxide, and hydrogen peroxide. In a semiconductor process, Tsukamoto teaches to use either a mixed solution of sulfuric acid and hydrogen peroxide or a mixed solution of ammonium hydroxide and hydrogen peroxide in order to oxide the surface of the silicon layer (paragraph 34). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ryu in view of Tsukamoto by using sulfuric acid and hydrogen peroxide solution because equivalent and substitution of one for the other would produce an expected result.

Respect to claim 13, Ryu teaches to repeat the step of oxidizing a portion of said surface layer and removing the oxidizing portion at least one (paragraph 0022-0024). Respect to claim 15, Ryu teaches the step of cleaning the surface layer prior to removing said surface so as to remove oxide residues (paragraph 0022). The limitation of claims 18 and 22, 31 have been discussed above under Ryu's reference. Respect to claim 32, Ryu teaches to clean the surface of said doped region prior to epitaxially growing a silicon layer so as to remove residues of the diluted oxidizing solution (paragraph 0024-0025).

The limitation of claim 33 has been discussed above. Respect to claim 35, Ryu discloses to adjust the temperature between 40-80 °C of the oxidizing solution for a given mixture ratio (paragraph 0023) base on the oxidation time (i.e. dipping time) and the thickness of the defect layer (24). Oxidation rate is the ratio of the oxidizing thickness (i.e. thickness of layer 24 to be oxidized) and the oxidation time. Respect to claim 36, Ryu teaches the step of cleaning the surface layer prior to removing said surface so as to remove oxide residues (paragraph 0022).

9. Claims 5-6, 16-17, 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ryu and Tsukamoto and further in view of Bergman (US 6,830,628).

Respect to claims 5 and 16, Ryu fails to disclose that the etch solution is applied by a spray tool. However, Ryu clearly teaches the etch solution is applied by dipping. In a semiconductor process, Bergman teaches to apply the etch solution can be applied using either a spray tool or dipping tank (col. 6 lines 60 to col. 7 lines 14). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ryu and Tsukamoto in view of Bergman by using a spray tool because equivalent and substitution of one for the other would produce an expected result.

Respect to claims 6, 17 and 25, Ryu and Tsukamoto fail to teach the step of rinsing the surface layer before or after applying the diluted etch solution. Bergman teaches to rinse the surface layer after applying the diluted etch solution to dislodge any residue on the surface (col. 7 lines 25-50). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ryu and Tsukamoto in view of Bergman by rinsing the surface after applying the diluted etch solution because it will help to dislodge any residue on the surface.

10a. Claims 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ryu and further in view of Gilton (US 6,437,417).

10b. Claims 19-20, 26-27, 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ryu and Tsukamoto and further in view of Gilton (US 6,437, 417).

Respect to claims 8, 19 and 26, Ryu or Tsukamoto fail to disclose the step of controlling the thickness of the removed surface by determining in advance an etch rate

of the etch solution and adjusting an etch time. Gilton teaches the etch rate is determined in advanced for example at 250 angstrom/min (col. 6 lines 22-33). Gilton further discloses the thickness of the removed layer and the etching time are related two each other base on the known etching rate. If the etching rate and the etching time are known, then it is possible to calculate the thickness of the removed layer. It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ryu or Ryu and Tsukamoto in view of Gilton by controlling the thickness of the removed surface based on the etch rate and etching time because these parameters are related to each other. By controlling the thickness using etching rate and etching time will help us to determine to endpoint of the etching process.

Respect to claim 9, 20 and 27, Ryu fails to disclose the step of determining the penetration depth of the contaminations (i.e. doped region) in said surface. However, Ryu clearly discloses to dope ion in to the surface to form a doped region (LDD region). A doped region certainly must a thickness value. Gilton discloses the penetration depth of the doped region is about 1000 angstrom (col. 5 lines 1-7). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ryu or Ryu and Tsukamoto in view of Gilton by determining the penetration depth of the doped region because it help us to determine the thickness of this doped region.

Respect to claim 37, the limitation regarding oxidation rate and oxidation time has been discussed above under Ryu's reference. The limitation regarding to etch rate and etching time has been discussed above under Gilton's reference.

11a. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ryu and further in view of Wang et al. (US 6,448,167).

11b. Claims 21, 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ryu and Tsukamoto and further in view of Wang et al. (US 6,448,167).

Respect to claims 10, 21 and 28, Ryu or Ryu/Tsukamoto fail to disclose the step of adjusting an under-etch of the sidewall spacers during removal of the surface layer. Wang teaches to adjust an under-etch of the sidewall spacers during the removal of the surface to create undercut region (9) (col. 4 lines 39-63, Fig 6). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ryu or Ryu/Tsukamoto in view of Wang by adjusting the under-etch in order to create under-cut region of the sidewall spacers.

12. Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ryu and Tsukamoto as applied to claim 33 above and further in view of Funabashi (US 2001/00391123).

Respect to claim 34, Ryu and Tsukamoto fail to disclose that ultrasound energy is supplied while cleaning the surface. Funabashi teaches to use ultrasonic while cleaning/etching the wafer surface with wet solution to shorten the processing time (paragraph 0071). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ryu and Tsukamoto in view of Funabashi by using ultrasound because it will shorten the processing time.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X. Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Binh Tran

Binh X. Tran